ON PROLONGING HUMAN LIFE

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Is old age a disease? No, it is not *a* disease, but it is disease. Neither old age, middle age nor youth are functions of time. They are physical states, the mere expressions of definite incident forces with which time has no more to do as a factor in causation than a tape measure with the height of a man. This is elementary, obvious and incontrovertible, and the only excuse for stating it as a principle is the fact that it is so generally ignored, not only in popular thought and language, but in philosophic and scientific discussion of the problems relating to human existence.

In casting time as an entity out of physics, Einstein has done no more than earlier thinkers have done for philosophy, yet so powerful is the influence of mere terminology and of allegorical conceptions of natural processes that even the pathologist dealing with visible evidences of infection and poison in the tissues of the elderly talks about "conditions normal to the *time* of life." The assertion that arterial hardening and other tissue changes, commonly although not always found in later life, are normal to that age period, is tantamount to asserting that they are due to time, a postulate that cannot really be presented in thought since time is a mathematical abstraction, has only a relative existence and cannot exert a physical influence over anything.

It may seem that I am merely harping on an academic string, but this is no academic question. It involves the demolition of a fallacious principle that has for ages held back the human race from enjoying the full fruits of human intelligence and attaining freedom from the thralldom of a mythological conception of the life cycle of man.

Once clear the mind of this paradoxical notion of the causation of old age and we strike at the roots of human misery, of human futility and failure. Today we stand humiliated before the brute creation. What can we, as

thinking organisms, report to the jungle as to our custody of human bodies and human lives? True, we have done some commendable things. We have cut down the death rate, both in war and peace, from certain diseases, while at the same time increasing the efficiency of our engines of destruction. We have cut down the death rate in places formerly pestilential, such as Panama and Havana, but the fact that we talk so much about these things is a pitiful commentary on the ages of ignorance and neglect through which we have passed, while deceiving ourselves with the mechanical trappings of civilization.

In spite of science, culture and the intellect of man, the "genus homo" is carrying at present a greater burden of disease, misery and starvation than any other animal organism. The life cycle of man is not only limited but filled with a mass of pathology, physical and mental, that is due to definite physical causes and preventable by definite physical means.

In considering problems relating to the quality of human life and the lines of its possible future development, we can make little progress unless we work and think in the spirit of Huxley who said "Sit down before fact as a little child, be prepared to give up any preconceived notion, follow humbly wherein and to whatever abyss nature leads, or you will learn nothing."

Current notions with regard to the duration of human life are based largely upon superficial observation and tradition. True, we are faced by the undeniable fact that one-half of the people die before sixty years of age. A lifetime of seventy years is considered as representing the human life cycle and is supposed to be fixed by biological, if not by a divine, law. In a sense this is true. That is, the human organism has evolved through many phases to a type that resists the unfavorable factors in environment and faults in its own structure for that period. The attacks of tubercle bacilli, of typhoid bacilli, of streptococci, the insidious effect of poisons formed in the body, as well as those admitted to the body, may be regarded as governed by natural law, but it is quite obvious that with larger knowledge of the operation of such laws, man's intelligence can set in motion influences also in accord with natural laws that can profoundly modify the life cycle of man or of any other organism. In earlier times such attempts were more along

supernatural than natural lines. Some mysterious and marvelous elixir or charm was sought that would enable mankind to withstand the so-called ravages of time, which we now know were mostly the ravages of micro-organisms. As science gained more light and divested itself of the superstitions and crudities of the alchemist and the medicine man, there was in fact very definite progress made in improving the death rate at certain age periods, chiefly under forty, when communicable and epidemic disease carries off its largest toll. This left untouched, however, the problem of mere ageing, of gradual failure in vitality, and final old age; and even those conditions frankly recognized as disease, such as arterial and kidney changes which claim in this country about 130,000 people yearly between the ages of thirty and sixty, have been wholly neglected as to their prevention. These casualties are accepted more or less philosophically as "acts of God," and no definite attempt to reduce the mortality from such causes has been made, as in the case of epidemic and communicable diseases. In fact, the death rate from these chronic maladies has increased in this country during the past thirty years and there has been no favorable influence on the mortality in the later ages of life, although in England and Wales and in the Scandinavian countries, and even in Prussia, the census returns indicate an improvement in the death rate at each age period. Various explanations have been offered for this apparently unfavorable trend, from absolute denial of the accuracy of the records by the optimist who would accept them unhesitatingly if they were pleasant and who does unhesitatingly accept the figures regarding the drop in the death rate from tuberculosis and typhoid, to the theory that it is due to the admixture of foreign stocks with a high mortality from such causes. There is good evidence that a substantial part of the increase in mortality from these organic diseases is, in fact, due to this cause, but there is no evidence that native stocks are showing any gain in vitality at the advanced ages. Hence, while the general death rate has been markedly reduced (from 19.6 to 14.2 in the registration area since 1890), there is no indication that the life span has been lengthened. The benefits of scientific progress have been conferred chiefly upon the young, but without apparently assuring them any more favorable condition in later life than has been enjoyed by their ancestors.

Evidently there is work to do along this line and these are the problems that interest most deeply those who joined in founding the Life Extension Institute. These men had no illusions as to the value of mere life extension. The sheltering and pampering and protecting of a defective organism in order to drag out a few more years of a more or less miserable existence would not be a fundamental service to humanity, although the duty of medical science is always to conserve life without regard to the burden that it places on society. The real meaning of life extension work lies in its ideal of living on higher planes of existence, in attaining a broader physical and psychic life, in developing the latent resources of mankind and in training man to make the most of his endowments and of his environment. This, it would seem, must inevitably lead to longer life and life so lengthened would improve social conditions generally and ensure an elderly life and old age free from many wretched handicaps.

What warrant have we for assuming that such things are possible? Does the failure thus far materially to increase the life span, in spite of scientific progress, prove that we are engaged in a Sisyphean task and working against nature or some irrevocable higher law? To me the testimony from the field of biology where profound changes have been effected in the life cycles of other organisms, offers a conclusive answer. The human organism cannot be separated from the rest of living organisms. If it can be shown that life cycles are not pre-ordained or immutably fixed, we may face the problem of extending the human life cycle, of expanding the power of the human organism exactly as we would face such problems in the laboratory when dealing with the fruit fly or the sea urchin or the star fish or the tadpole. There are living organisms such as the redwood tree, that have a life cycle apparently limited only by the geologic age in which they live. There are others that live but a day because of obviously faulty structure. Working with the fruit fly, Loeb and others have prolonged the life cycle of this organism 900 per cent merely by keeping it at a lowered temperature and protecting it from adverse external factors, such as infection and poison.

There are numerous similar experiments on record where the so-called influence of time has been defied and a definite prolongation of the life span attained. Loeb has

emphasized the significance of the result attained with the fruit fly as evidencing the attainment of natural death, that is, death occurring notwithstanding the protection of the organism from all forms of external injury or infection. It was assumed that death finally occurred either from loss of peculiar substances formed by the organs of the creature and necessary to maintain the mechanism of its existence, or the accumulation of poisons which were never thoroughly eliminated from its body, owing to some faults in structure. It is probable that here we have an expression of a fundamental law of life. Barring accident or injury, all organisms die through fault in their structure or their adaptation; because they are poisoned, infected or deprived of essential factors that maintain life. These definite causes of disease, old age and death can actually be grouped under definite categories that will include all possible factors yet to be discovered that could influence the life cycle of man. These categories are as follows: Heredity, Infection, Poison, Food deficiency, Food excess, Hormone deficiency (Hormones are substances essential to maintaining the equilibrium of health and the efficient functioning of organs. They are known to be formed in a number of glands and organs, such as the thyroid, adrenals, pituitary, sexual glands, the pancreas and possibly some others), Hormone excess (actually poison), Physical injury or strain, Psychic injury or strain, Physical apathy, Psychic apathy.

Clifford once said that from a cubic inch of air omniscient science could reconstruct the whole plan of the universe, and it may be said with equal truth that science fully informed as to the means of protection against the adverse factors named or yet to be named under these categories, could indefinitely prolong human life—and more—indefinitely expand its power. This, of course, is a mere presentation of a principle and not a prediction. No one with even a smattering of scientific knowledge can doubt that the best of us are merely nibbling at life. Evolution has after many years brought us to a point where we look back with contempt upon the Pithecanthropus Erectus and the Neanderthal man, but it is doubtful whether we are much in advance of the Cro-magnon man whose superior intelligence did not save him from extinction. Despite our civilization which we are wont complacently to speak of as complex, although it is really superficial, there is no evidence

that moderns excel in brain power or in intellectual stature the wise men of old. We have more information, we have discovered more about the mechanism of the universe, but the quality of the human organism shows very little evidence of improvement, notwithstanding the current belief in "upward" evolution.

Professor Edward Grant Conklin, in a recent Princeton lecture, has dissented from this view of further upward evolution as applied to man. He sees little probability of a superman appearing and points to evidence of actual physical deteriorations in the modern human type as compared to earlier types. These relate, it is true, to comparatively minor matters such as skeletal changes, decrease in the acuteness of special senses and the like, but there is lacking in the biologic record any evidence of upward development during the historical period. On this subject I have no dogmatic opinion and would not venture to assert that modern man is distinctly inferior physically to ancient man, but I have a very positive opinion as to the present physical condition of man, and that is, that he is far below a reasonable standard of animal excellence. Where among wild animals can you find so many individuals with septic teeth, faulty vision, septic tonsils, inefficient bowels, physical asymmetries, flat foot, defective and infected nasal cavities, defective hearing, unhealthy skin, impaired organs and tissues? When man first moved into this pathological field I cannot say. It is claimed that the ancient Egyptians had their tooth troubles.

It may be that Professor Conklin is right and that natural evolution has reached a biological *impasse* in man, but on this subject we are entitled to hear from the clinician, the physiologist and the hygienist, as well as the biologist. Admitted that without help, evolution can do no more, we are at liberty to speculate on the power of intellect to control nature. Huxley postulated a reversal of natural selection through man's interference in preserving the unfit; the contrary hypothesis is tenable that man can take up the work where nature laid it down and by directing natural forces, deliberately mould a higher type of organism. This would seem to be the real hope of the future.

That immense opportunities confront human intelligence, cannot be doubted. That a transformation of the human type is possible with a vast access of power and

vision and capacity for bending to its will the resources of nature, is the underlying thesis of this article. Possibly man is but another trial in the "great plan." No less than 10,000,000 species have existed on the earth, many of them for vast stretches of time, only to pass out. It may be that another and another biological cycle will be necessary before the real man comes, nevertheless we find ourselves with a definite hold on facts that were denied to previous civilizations so far as we can learn. We can see definite means of working forward to a practical solution of mysteries that our forefathers placed in the sphere of the supernatural.

From these ambitious reaches of thought, let us come down to earth and ask what really does this all mean to the man on the street? Have we any message for him? Surely there is a direct and practical message. From the sublime to the ridiculous is but a step, but we can reverse the formula and say that from the ridiculous to the sublime is often but a step. Little Tommy Grace with a pain in his face is not sublime, but the change that can be wrought in a human being by the removal of a root abscess often approaches the sublime and may appear almost as miraculous as the healing of the sick by the laying on of hands. This does not apply to all root abscesses, but to some, and 62% of people whose teeth we have X-rayed showed root abscesses. I do not mean to convey the impression that all our ills are due to our teeth, but make the point that something at least is known regarding definite menacing factors grouped under the categories I have mentioned as influencing the life cycle, and that something is also known regarding definite means of protection. With reasonable cooperation from the individual and from organized society, I have little doubt but that the span of human life could easily be extended well beyond one hundred years and, what is more to the point, expanded and much of the sordid misery and the humiliating limitations squeezed out of it. Too much must not be expected in a decade or in a century, and yet the Egyptians under the third and fourth dynasties emerged from comparative barbarism and in less than a century developed a culture and an engineering and architectural skill that produced the pyramids. Without making predictions or fixing time limits, we can tell our story and do our work, and, to use the old phraseology, let "time" do the rest.

First, eugenics is a science to reckon with. If man's in-

telligence cannot in the course of time reduce the stream of gross deficiency by some means of controlling breeding, then will the real man have to come into his own and that job must be left to some higher race of organisms yet to appear. Dodging the platitudinous dialectic brick-bats that this assertion invites, let us consider the infant who is here. Prenatal care offers definite promise of better equipment for the infant. Infant and child hygiene are even now doing much. Nutritional problems are being solved. Physical training problems are with us. Mental training is baffling the wisest minds and there regularly appear in our leading magazines wails of agony from educators and philosophers deploring our deficiency in this regard.

But what of the young adult cast upon the great ocean of life to strike out for some unknown shore? Our draft examinations told us something about the male and would have told a similar story about the " deadlier of the species " had she been called. In spite of much care in earlier years, this young male in the flush of youth showed deficiencies. He needed just the kind of physical overhauling that he received, only a more thorough one.

Shortly before the war, General Leonard Wood asked me to estimate the probable rejection rate if a draft should be necessary. I answered " 50% if we take ages 18 to 45." He replied, " That is conservative, judging from my own observation of recruits examined." You see, General Wood was not an optimist, but just a military and medical scientist, viewing the matter cold-bloodedly, " sitting down before fact as a child." Probably more crimes or at least mistakes have been committed in the name of optimism than in the name of liberty, and we may charge to optimistic amblyopia at least one-fourth of the present world misery, not to speak of the war casualties.

The draft actually revealed about one-third of those examined between the ages 21 and 31 disqualified for active service. The rejection rate rises rapidly with age and at least a 50% rate would have been reached as a total if ages to 45 had been included. There was an excess of 30% in the rate for the entire age group, as against age 21 in our draft, and in Great Britain the rejection rates, according to Major Comrie, were: age 18—23%, age 23—48%, age 41—69%.

We see this paralleled in the death rate in the population.

At age 40 the death rate is about three times what it is at 20. My own predictions were based not only upon many years of observation of life insurance risks, but upon recent evidence derived from the examinations by the Life Extension Institute of many thousands of industrial employees active at their work and others in all walks of life. More than half of these people, forming a cross section of the population down to and including the average active worker in industry but not including the sick and dependent and unemployed, were found in need of some form of medical, dental or surgical treatment, and practically all had at least some slight defect, the correction of which would improve their life prospect if not their immediate condition. In addition to physical defects, faults in living obviously impairing their lives, were found in more than 80%. Errors in diet, exercise and personal hygiene were so common as plainly to reveal the lack of adaptation of the human animal to his surroundings.

In the British draft records it was found that four-fifths of those examined had defects worthy of record. In our draft statistics, we find 47% recorded as having reportable defects.

In the Life Extension Institute reports of more than 150,000 physical examinations, we do not find the record of any perfect man or woman. There is always some departure from ideal physical condition, there is always something that can be done. From those showing a high state of vitality and minor defects, only a very small percentage, we step down to those showing really serious and advanced disease,—about 5 to 8% in any working population, people actually at work and supposedly in good health. A concrete case will illustrate. A man fifty years of age, examined in a group of supposedly healthy workers as a matter of routine, claimed to be in good health and had no complaint except callouses on his feet. On examination, he was found to have a blood pressure of 220, his kidneys were advanced in disease, he had septic teeth and tonsils, his vision was defective and he was wearing defective glasses purchased at a store. He was consuming large quantities of coffee, tea and tobacco, and he had callouses on his feet! Poor man! Much could be done even for him by clearing his mouth of infection, by regulating his diet and habits, and fitting him with proper glasses. He is not an uncommon type. Cal-

louses on his feet! No, the callouses are on the brains of society and of science that has for ages stood waiting for people to come and report that they have callouses on their feet, or what not, instead of periodically overhauling the human body to find out whether any of the factors grouped under the categories I have mentioned are at work. This particular man may have had rising blood pressure and developing kidney trouble for 15 or 20 years. The early signs are often found in young people.

In a group of several thousands of insurance policyholders examined periodically under this system for the purpose of prolonging their lives, the death rate during a period of seven years was cut down 50%. It has been figured by a leading statistician that the periodic examination of any group will save at least three lives per thousand per annum, apart from the dividends in increased living capacity. This is the practical work of life extension now being carried by the Institute into industry, among life insurance policyholders and among its own members who join in this work, not only to gain its benefits for themselves, but to extend it throughout society. Health construction and disease prevention placed on a practical business basis and carried through practical business channels, gives economic as well as psychic and moral dividends.

Apart from the prolongation of life by such practical means, we must, as honest scientific thinkers, face the possibilities of more direct and specific measures. We have already sufficient light on this pathway leading to strange and startling possibilities, enabling us to discern a world transformed. We know that diet is not so simple a matter as formerly supposed. Specific substances, vitamins, are necessary in our food for growth and development and the maintenance of health, entirely apart from the chemical elements and simple combinations of protein, carbo-hydrates, fats, minerals, etc., formerly regarded as sufficient. Strange and terrible diseases arise from lack of such substances,—beriberi, scurvy, pellagra, and possibly other forms of disease. We also know that the autonomic nervous system and certain glands over which it presides form substances essential to life and health and well-being,—hormones. Excess or deficiency of hormones may cause profound changes not only in physical condition, but in character and personality. Sex expression, which is one of the most basic formative

elements in personality during the greater part of life, can be wholly changed by alteration in the gonads or sex glands, and in animals the transplantation of glands has shown the transformations possible along these lines.

Science must face this fact as to the influence of these bio-chemical factors on the integration and disintegration of personality. It is well to throw a dash of cold water on the present tendency to discuss personality as an entity which can go out walking and then return to snuggle once more in the body.

The question arises as to where the personality comes from that a cretin obtains when he emerges from incipient idiocy to intelligence as a result of feeding him thyroid gland? There is, so far as I know, no evidence that the human mind can grasp, to explain this phenomenon otherwise than on the hypothesis of an integration of personality arising from the bio-chemical changes in the body of the subject.

Professor Francis G. Benedict, in his experimental work on a squad of men that had been adjusted to a low plane of nutrition (about two-thirds of the supposed minimum standard requirement), men organically sound and physically able not only to work but to excel in endurance tests, found a remarkable change in sex expression and consequently in personality, due to changes in the bio-chemical adjustment of the subjects. These men had low blood pressure, slow pulse rate and lowered metabolism, they were "bailed" of considerable reserve nitrogen, and their physiological condition and their outlook on life during the period of the tests were profoundly altered, that is, in the majority of these subjects, owing to practical obliteration of sex expression,—physical, psychic and aesthetic.

The many examples of profound physical and psychic changes resulting from variation in the supply of hormones or other specific substances, indicate the possibility of ultimately acquiring knowledge that will enable us to administer combinations of substances that will maintain life and health indefinitely, barring accident or physical and mental strain and injury, although these may conceivably be successfully combatted to a certain degree by specific means. Carrying these speculations to their ultimate implication, we find a number of alternative destinies confronting mankind.

Regulation of the birth rate, or an artificial death rate,

would be inevitable if the so-called natural death rate were reduced to a negligible factor. A condition of society would obtain strange beyond belief and so different from the present world as to be unrecognizable by one who could awaken in it like Rip Van Winkle after a long sleep.

The attainment of longevity by regulation of conduct, by following the rules of personal hygiene and bending the body to the will of the individual, is not likely to cause any social upheaval or dislocation. Such influences working gradually would be accompanied by social adjustment to a longer life cycle. Let us therefore be neither optimistic nor pessimistic, but just good citizens courageous to face the truth as to our weaknesses and to move for their correction. Periodic physical examination and an intelligent regulation of our lives, of our social and industrial conditions, may seem a commonplace formula after discussing an elixir of life, but it will do much to lift the burden of woe and of error that now weighs down the nations of the world.

It is useless to argue that nobody wants to live longer than the present life span. I venture to assert that if simple means be found greatly to prolong human life, that is, without working for it, few would be found to make the decision against utilizing it, and no doubt nations would fight for it.

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